CLAIMS

1. A method of processing a workpiece in a chamber, the method comprising:

(a) striking a plasma in the chamber;

(b) treating the workpiece by cyclically adjusting the processing parameters between at least a first step having a first set of processing parameters and a second step having a second set of process parameters; and

(c) stabilising the plasma during the transition between the first and second steps.

2. A method according to Claim 1, wherein the plasma is stabilised between each cyclic step.

3. A method according to Claim 1 ~~or 2~~, wherein the workpiece is treated by cyclically carrying out alternating etch and deposition steps.

4. A method according to ~~any one of Claims 1 to 3~~ Claim 1, wherein RF power is inductively coupled into the plasma.

5. A method according to ~~any one of Claims 1 to 4~~ Claim 1, wherein the plasma is stabilised by matching the impedance of the plasma to the impedance of the power supply which provides energy to the plasma by means of a matching unit.

6. A method according to Claim 5, wherein the matching unit is adjustable manually or electrically.

7. A method according to Claim 5 ~~or Claim 6~~, wherein the plasma impedance is matched to the power supply impedance automatically for at least a part of the time of treatment

of the workpiece.

8. A method according to ~~any one of Claims 5 to 7~~ Claim 5, wherein the matching unit is pre-set to act in time at or just before the transition between the first and second steps.

9. A method according to Claim 8, wherein automatic matching is enabled when the chamber pressure and/or other parameters have stabilised.

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10. A method according to ~~any one of Claims 7 to 9~~ Claim 7, wherein the automatic matching is disabled at or slightly before the transition.

11. A method according to ~~any one of Claims 5 to 10~~ Claim 5, wherein the matching unit is driven by a motor.

12. A method according to Claim 11, wherein control signals are used to drive the motor and are modified to track impedance changes rapidly.

13. A method according to ~~any one of Claims 5 to 12~~ Claim 5, wherein the matching unit comprises capacitors having set initial values for succeeding steps of the same type which are ramped or otherwise adjusted during the overall process.

14. A method according to Claim 13, wherein the initial values for a step of one type are obtained from the values found from automatic matching at the end of the previous step of the same type.

15. A method according to Claim 13, wherein the capacitors in the matching unit are adjusted to different values for each of the steps, and/or the frequency of the

power supply is altered, either by a direct command or by an automatic control circuit.

16. A method according to Claim 15, wherein frequency adjustment of the power supply or pre-setting of the frequency for each of the steps to achieve matching of power into a plasma is utilised to reduce or eliminate the need to adjust matching unit capacitor values.

17. A method according to Claim 15 ~~or Claim 16~~, including fixed matching unit capacitor positions, which do not vary between etch and deposition steps, and either a pre-set or automatically adjusted frequency of the RF from the power supply.

18. A method according to Claim 15 ~~or Claim 16~~, including fixing of the matching unit capacitor positions to different appropriate settings for etch and deposition steps, and then either pre-setting or automatically adjusting the frequency of the RF from the power supply.

19. A method according to ~~any one of Claims 1 to 18~~ Claim 1, wherein stabilisation of the plasma is enhanced by substantially preventing or reducing variation of the pressure in the chamber between the first and second steps.

20. A method according to Claim 19, wherein, during a cyclic etch/deposition process, the deposition gas is supplied, or increased in flow rate, before the etch gas is switched off, or reduced in flow rate, and the etch gas is supplied, or increased in flow rate, before the deposition gas is switched off, or reduced in flow rate.

21. A method according to Claim 20, wherein either of the etch or deposition gases are allowed to flow throughout the switched process or for a significant proportion of it.

22. A method according to Claim 21, wherein the deposition gas continues to flow throughout the etch step in addition to the deposition step, but normally at a much reduced rate, while the etch gas is only permitted to flow during the etch step.

23. A method according to Claim 21, wherein the etch gas continues to flow throughout the deposition step in addition to the etch step, but normally at a much reduced rate, while the deposition gas is only permitted to flow during the deposition step.

24. A method according to Claim 21, wherein both etch and deposition gases are allowed to flow simultaneously and continuously.

25. A method according to [claim 20] ~~any one of Claims 20 to 24~~, wherein the respective flow rates of the gases generally vary for each of the steps.

26. A method according to [Claim 10] ~~any one of Claims 1 to 25~~, wherein stabilisation of the plasma is enhanced by feeding a further gas into the chamber.

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27. A method according to Claim 26, wherein the further gas is fed into the chamber by means of a fast acting flow controller.

28. A method according to Claim 26 ~~or 27~~, wherein the further gas is selected from helium, argon or other noble

gas, oxygen or nitrogen or a mixture thereof.

29. A method according to Claim 26 ~~any one of Claims 26 to 28~~, further comprising monitoring the pressure in the chamber and adjusting the flow of the further gas accordingly.

30. A method according to Claim 1 ~~any one of Claims 1 to 29~~, wherein the total pressure in the chamber is ramped during a particular step.

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31. A method according to Claim 19 ~~any one of Claims 19 to 30~~, wherein the chamber is provided with a portion separated from the main part of the chamber by a deflectable member.

32. A method according to claim 31, wherein the separated portion is of a volume which is large compared to the main part of the chamber.

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33. A plasma processing apparatus comprising a chamber having a support for a workpiece, means for striking a plasma in the chamber, means for cyclically adjusting processing parameters between a first and a second step, and means for stabilising the plasma during the transition between the first and second steps.

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34. A plasma processing apparatus according to Claim 33, wherein the stabilising means comprises a matching unit for matching the impedance of the plasma to the impedance of a power supply which supplies power to the plasma.

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35. A plasma processing apparatus according to Claim 33 ~~or 32~~, wherein the stabilising means comprises means to vary the RF power supply frequency, or means for reducing the variation of the pressure in the chamber between the first and second steps.

36. A method of processing a workpiece in a chamber substantially as hereinbefore described with reference to the accompanying drawings.

37. A plasma processing apparatus substantially as hereinbefore described, with reference to, and as illustrated in, the accompanying drawings.